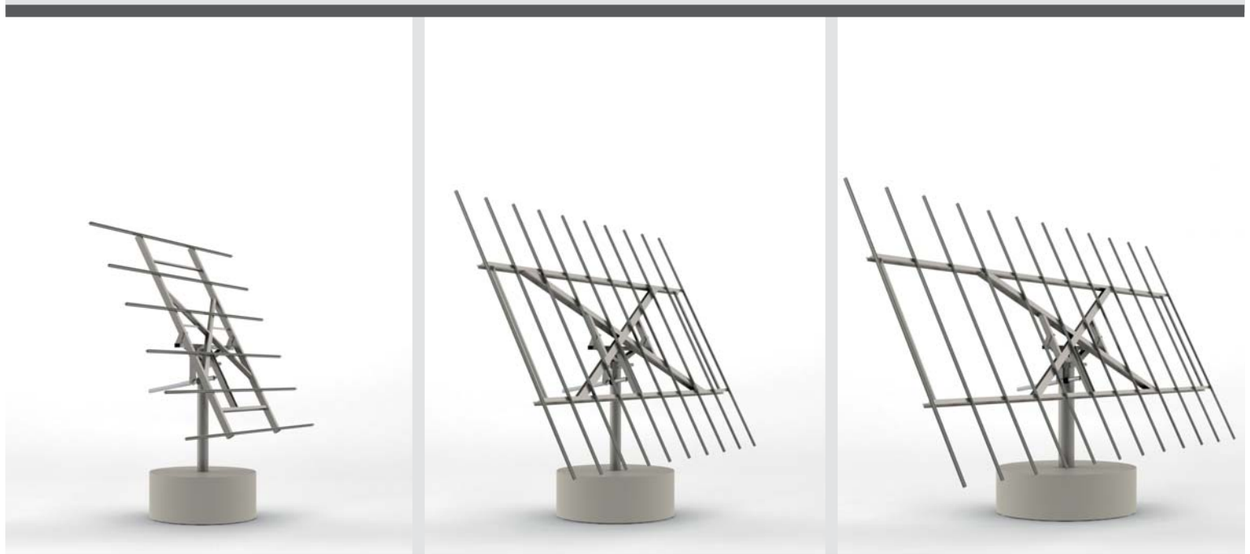
DEGER ENERGIE
SOLAR TRACKING SYSTEMS

PRODUCT GUIDE

DUAL-AXIS

OPEN LAND



DEGERtraker® 3000NT | **DEGERtraker®** 5000NT | **DEGERtraker®** 7000NT

	DEGERtraker® 3000NT	**DEGERtraker®** 5000NT	**DEGERtraker®** 7000NT
For solar energy capacity	2.000 ... 4.000 Wp	4.000 ... 7.000 Wp	6.000 ... 10.000 Wp
Module area up to	25 m²	40 m²	60 m²
Rotation angle east - west	360° with adjustable limit switches		
Elevation inclination angle	15° ... 90°		
Control unit	DEGERconecter		
Energy converter	II or V		
East - west drive	drive integrated in the rotating head		
Elevation drive	1.000 mm stroke path	1.000 mm stroke path	1.100 mm stroke path
Internal power consumption:			
control mode	1 Watt		
with operating drives approx.	7 Watts	9 Watts	---
Power consumption per year approx.	7 kWh	8 kWh	9 kWh
Mast height	3,3 ... 5,5 m		
Maximum allowed wind speed	102 ... 300* km/h		
Weight (excluding mast)	480 kg	650 kg	1.090 kg
Maintenance	maintenance-free		
Geographic region	25° ... 60° / optional equator to 90th degree of latitude		
Art.no.	1300001	1500001	1700001

Dual-axis, active tracking system suitable for all current solar modules

Areas of application:

- For professional power generation.
- For open spaces and for installation with different mast lengths.
- For all current modules.

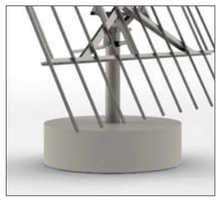
Scope of delivery:
Complete dual-axis tracking system, mast, aluminium solar module carrier system to fit the respective module type, DEGERconecter control electronics with energy converter for extremely economical operation, foundation plan, installation manual.

The systems are designed in accordance with DIN 1055-4 (03/2005). Project-specific assimilation to regional provisions.
Subject to technical changes for future improvements.
* designed with planning tool.

DUAL-AXIS

BUILDING INTEGRATION AND OPEN LAND

Open land



Open land

DEGERtraker® 3000HD | **DEGERtraker®** 5000HD

	DEGERtraker® 3000HD	**DEGERtraker®** 5000HD
For solar energy capacity	2.000 ... 4.000 Wp	4.000 ... 7.000 Wp
Module area up to	25 m²	40 m²
Rotation angle east - west	360° with adjustable limit switches	
Elevation inclination angle	15° ... 90°	
Control unit	DEGERconecter	
Energy converter	II or V	
East - west drive	drive integrated in the rotating head	
Elevation drive	1.000 mm stroke path	1.100 mm stroke path
Internal power consumption:		
control mode	1 Watt	
with operating drives approx.	7 Watts	
Power consumption per year approx.	8 kWh	9kWh
Mast height	3,3 m ... 5,5m	
Maximum allowed wind speed	170 ... 300* km/h	
Weight (excluding mast)	500 kg	850 kg
Maintenance	maintenance-free	
Geographic region	25° ... 60° / optional equator to 90th degree of latituded	
Art.no.	1310001	1510001

Dual-axis, active tracking systems suitable for all current solar modules

Areas of application:

- For professional power generation
- For buildings and for installation with different mast lengths.
- For all current modules.

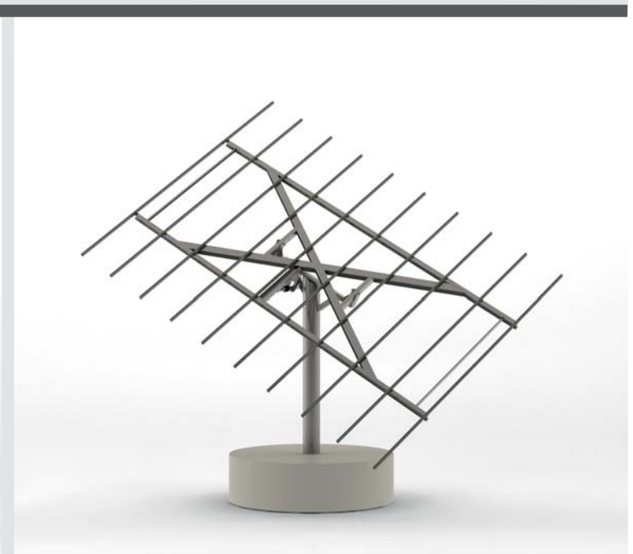
Scope of delivery:
Complete dual-axis tracking system, mast, aluminium solar module carrier system to fit the respective module type, DEGER-conecter control electronics with energy converter for extremely economical operation, installation manual.

HD models:
Heavy-duty models (HD) are also available with mast to be installed on open land. (Deep-sea islands, zones with strong winds)

The systems are designed in accordance with DIN 1055-4 (03/2005). Project-specific assimilation to regional provisions.
Subject to technical changes for future improvements.
* designed with planning tool.

SINGLE-AXIS

OPEN LAND



DEGER TOPtraker® 8.5

with concrete foundations for outdoor installation

DEGER TOPtraker® 40NT

	DEGER TOPtraker® 8.5	DEGER TOPtraker® 40NT
For solar energy capacity	500 ... 1.300 Wp	4.000 ... 7.000 Wp
Module area up to	8,5 m²	40 m²
Angle of inclination - south	30° / optional 20°	Standard 30° / optional 0° und 15°
Elevation inclination angle	max. +/- 45°	max. +/- 45°
Control unit	DEGERconecter	
Operating voltage	20 ... 40 VDC	Energy converter II
East - west drive	420 mm stroke path	850 mm stroke path
Internal power consumption:		
control mode	0,1 Watt	
with operating drives approx.	5 Watts	9 Watts
Power consumption per year approx.	1 kWh	2,5 kWh
Mast height	---	4 m / optional 5 m
Maximum allowed wind speed	130 ... 300* km/h	102 ... 300* km/h
Weight (excluding mast)	115 kg	650 kg
Maintenance	maintenance-free	
Geographic region	Equator ... 60. latitude	
Art.no.	1110001	1130001

Single-axis, active tracking system suitable for all current solar modules

Areas of application:

- For increased performance for all photovoltaic applications.
- For open spaces and landfills.
- For all current modules.

Scope of delivery:
Complete tracking system in the optimised azimuth axis, DEGERconecter control electronics, module bearing system in aluminium, compatible with the module type used, installation manual.

The systems are designed in accordance with DIN 1055-4 (03/2005). Project-specific assimilation to regional provisions.
Subject to technical changes for future improvements.
* designed with planning tool.

SINGLE-AXIS

BUILDING INTEGRATION
AND OPEN LAND

Open land

DEGER TOPtraker® 8.5

without concrete foundations for flat roof installation

DEGER TOPtraker® 25HD

	DEGER TOPtraker® 8.5	DEGER TOPtraker® 25HD
For solar energy capacity	500 ... 1.300 Wp	2.000 ... 4.000 Wp
Module area up to	6,1 m² ... 8,5 m²	25 m²
Angle of inclination - south	30° / optional 20°	Standard 30° / optional 0° und 15°
Elevation inclination angle	max. +/- 45°	max. +/- 45°
Control unit	DEGERconecter	
Operating voltage	20 ... 40 VDC	Energy converter II
East - west drive	420 mm stroke path	850 mm stroke path
Internal power consumption:		
control mode	0,1 Watt	
with operating drives approx.	5 Watts	7 Watts
Power consumption per year approx.	1 kWh	2 kWh
Mast height	---	4 m / optional 5 m
Maximum allowed wind speed	130 ... 300* km/h	170 ... 300* km/h
Weight (excluding mast)	115 kg	560 kg
Maintenance	maintenance-free	
Geographic region	Equator ... 60. latitude	
Art.no.	1110001	1120001

Single-axis, active tracking systems suitable for all current solar modules

Areas of application:

- For increased performance for all photovoltaic applications.
- For flat roofs, landfills and buildings.
- For all current modules.

Scope of delivery:
Complete tracking system in the optimised azimuth axis, DEGERconecter control electronics, mast for TOPtraker 25HD, module bearing system in aluminium, compatible with the module type used, installation manual.

HD models:
Heavy-duty models (HD) are also available with mast to be installed on open land. (Deep-sea islands, zones with strong winds)

The systems are designed in accordance with DIN 1055-4 (03/2005). Project-specific assimilation to regional provisions.
Subject to technical changes for future improvements.
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CONCENTRATOR TECHNOLOGY

DUAL-AXIS

A MILESTONE IN CONCENTRATED SOLAR TECHNOLOGY

Concentrated solar technologies, such as CPV, need modules to be very accurately aligned towards sunlight. The mass-produced DEGERtraker, in conjunction with the new DEGERconecterCT control, provides an unbeatable price/performance ratio. The high-precision tracking system is the product of 24 months of research and development, and has achieved a tracking precision of 0,03° under laboratory conditions. Nine systems have already been subjected to long-running tests on the company's own test grounds. Amongst the standard models, the DEGERtraker 3000CT and 5000CT work with an accuracy of less than 0,1°.

Building integration

DEGERtraker® 3000CT

Building integration

DEGERtraker® 5000CT

	DEGERtraker® 3000CT	**DEGERtraker®** 5000CT
System type	2-axis, active	
Control unit	DEGERconecterCT	
Azimuth	300°	
Elevation	15° ... 90°	
Drive unit	electromechanical	
Power consumption	7 Watts	9 Watts
Driving gear	high-load gear, linear drive	
Max. module surface	25 m²	40 m²
Permissible wind velocity with max. module surface	170 km/h	
Permissible wind velocity with reduced module surface	up to 300 km/h	
Weight	approx. 1.100 kg	approx. 1.600 kg
Ground clearance	approx. 1 m	
Installation	Building integration, concrete foundation or dowel	
Year of market launch	01/2010	
Worldwide sales	yes	

CONCENTRATOR TECHNOLOGY

PRECISION IN TRACKING

CONCENTRATOR PHOTOVOLTAICS (ABBREVIATED TO CPV)

For many years now the solar industry has worked with various approaches involving concentrated solar radiation. The principle is simple: In combination with precise tracking, solar radiation is concentrated on special concentrator solar cells.

Concentrator technology is now facing a crucial breakthrough into commercial use as well. DEGERenergie has responded to this development and is now offering 2 tracking systems developed exclusively for concentrator technology.

CPV, when combined with our CT models, has the greatest potential for reducing production costs and of being successfully used with the highest levels of efficiency.

The success of CPV technology essentially depends on three components: high-performance solar cells, optics and tracking. DEGERenergie has developed a system specifically relating to tracking that is competitive and based on years of experience in the solar industry.

POTENTIAL TO MEET DEMANDS

Precise tracking is crucial on tracking systems in order to use CPV technology efficiently. The slightest deviations are immediately reflected in the efficiency and yield. Structural modifications to the supporting structures must be taken into account due to the high weight of the new CPV technologies. The new CT models are predestined for such high demands.

THE DEGERconecter

DEGERtraker's CONTROL SYSTEM

ACCURATE ADJUSTMENT
The DEGERconecter always adjusts the solar installation to face the brightest point in the sky. It includes the entire system control.

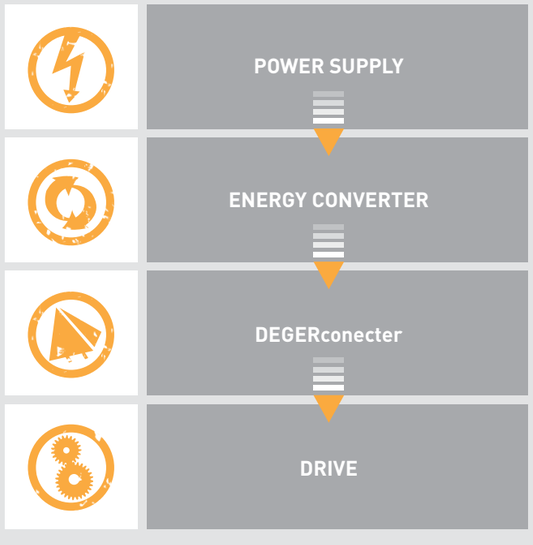
MAXIMUM POWER YIELD
During times of sunshine the module surface is accurately adjusted to face the sun. During times of overcast weather, the DEGERconecter automatically adjusts to face the point with the strongest global radiation. A control system to rely on. The patented DEGERconecter control was distinguished with the Innovator Award of Baden-Wuerttemberg Prize in 2001, has been continuously improved and has more than 50.000 units in operation.

DESCRIPTION OF DEGERconecter FUNCTIONS
Two sensor cells in the DEGERconecter supply reference values which are evaluated by the logic device and which provide the basis for the adjustments of the module surface in the course of the day. A third sensor cell is attached to the back of the DEGERconecter to reset the installation in the morning. Depending on the irradiation intensity, a differential amplifier controls the transition from the logarithmic characteristic curve during strong irradiation to a linear characteristic curve during low currents in diffuse light. That means that the logic device accepts a much higher value for the linear characteristic curve than for the logarithmic characteristic curve. This leads to improved adjustment accuracy in dim light. A load is added to the differential voltage, moving the switch-off threshold further into dusk, to approx. 30 W/m^2.

DRIVE CONTROL
The drive is controlled directly – and without requiring additional parts – by the MOSFET bridge circuit, which is integrated in the DEGERconecter The bridge is characterised by a very low closing resistance. To avoid overload of the motor and the DEGERtraker's structure, a current limiter was integrated into the system. This current limiter functions dynamically, i.e. the motor is switched off as a response to overload (e.g. frozen or blocked drives). As soon as the drive works again, the system resets automatically.

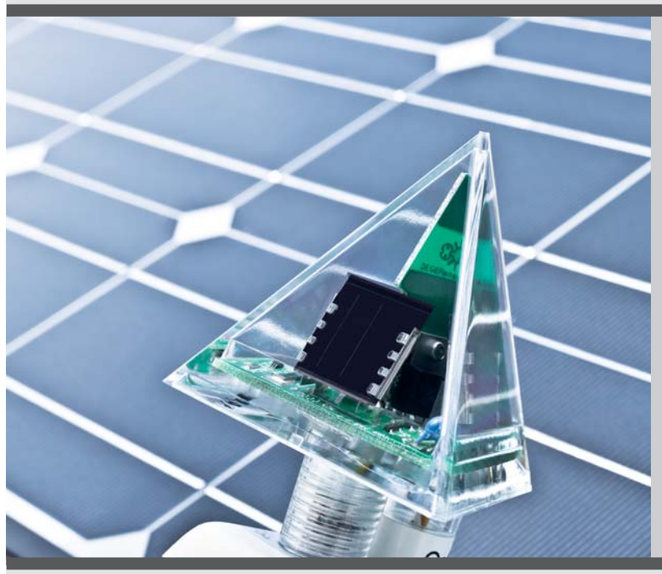
TASKS OF AN ENERGY CONVERTER
The energy converter exploits wide voltage ranges of solar modules, battery systems and the grid for the DEGERconecter. The power for the control and drive systems may also be supplied without a battery, by direct connection to solar modules with less than one Watt power.
During dawn, the DEGERconecter recognises the brightest spot in the sky and resets the installation. The power supply module for the control system starts by producing 0,01 Watt or less, and as soon as the DEGERconecter attempts to control the electric motor, the voltage on the solar module breaks down. To avoid the DEGERconecter switching the drive on and off all the time and to achieve quick resetting, DEGERenergie has developed the energy converter. The energy converter collects even small power inputs from the solar module (which are too small to be fed into the grid) in a high performance condenser and makes this energy available to the DEGERconecter. The DEGERconecter is thus able to reset the installation to face the brightest spot even before the modules produce enough energy to be fed into the grid. To avoid both drives from working simultaneously, the energy converter gives the east-west drive priority over elevation. The energy converter also ensures that not more than approx. 1 – 3 Watts is drawn from the solar module while the drive is running. The control does not use any energy during the night.

CIRCUIT DIAGRAM



THE DEGERconecter

THE PATENTED CENTREPIECE



BENEFITS

- No computer with high energy consumption required
- No rotation angle potentiometer, relay, step motors ... required
- No networking with data lines required
- The automatic drive does not contain any electro-mechanical parts
- Little cabling required for large solar parks
- Simple, easy-to-use control technology
- Also bad weather is used efficiently
- Contrary to traditional control systems only movements are performed, that lead directly to a yield increase.

TECHNICAL DATA	DEGERconecter	DEGERconecterCT
Input voltage	18 ... 50 VDC	
External input fuse	5 Ampere	
Internal power consumption at night	0 Watt	
Internal power consumption control mode	0,1 Watt	
Input protection	reverse polarity protection diode max. 5 A	
Output voltage	see input voltage	
Output on motor side	short-circuit proof, reverse polarity protected	
Motor protection	overload recognition, current limitation	
Switching capacity loss-free	4 Ampere	
Peak switching capacity	9 Ampere	
Adjustment accuracy in sunshine	< 1°	< 0,1°
Adjustment accuracy in diffuse light	< 6 %	---
Measurement	edge length 80 mm	410 x 80 x 170 mm
Weight	90 g	660 g

ENERGY CONVERTER	I	II	III	V
Input voltage	9 ... 34 VDC	24 V (20 ... 30 VDC)	80 ... 380 VDC or 80 ... 265 VAC	
Connection	independent of polarity			
Output voltage	22 VDC			
Power consumption with motor	3 Watts	20 Watts	5 Watts	20 Watts
Internal power consumption control mode approx.	0,1 Watt	0 Watt	1 Watt	1 Watt
Output on motor side	short-circuit proof			
Measurement	130 x 130 x 80 mm			
Weight	440 g	600 g	570 g	600 g
Input external drive system	no	yes	yes	yes

ADVANTAGES THAT PAY FOR THEMSELVES

INNOVATION & EFFICIENCY: TWO REASONS FOR UP TO 45 % MORE ENERGY

SIMPLE & INGENIOUS

- The patented control for high yields
- Low internal consumption (0,2 % of excess yield) – no power-hungry computer in the background
- High availability (99,9 %) – decentralized control with fail-safe program
- Clever control: takes full advantage of snow glare and eye-of-cloud effect!
- Simple, easily mastered control electronics (no angle transmitter, relays, stepper motors ...); which means easy maintenance
- Low cabling requirements for large-scale solar parks: no networking with data cables required
- Clever exploitation of poor weather conditions
- In contrast to conventional control systems, movements are only executed that directly produce an increase in yield
- Effective control, independent working method with individual control – single clouds only affect the corresponding area of the solar park
- High accuracy with large sensor areas, no impairment from dirt and grime
- The DEGERconecter makes automatic adjustments on soft subsurfaces and when foundations settle – safety during long-term operation without the need for tests

DEGERtraker/TOPtraker – WE BRING MOVEMENT TO THE SOLAR INDUSTRY

- Highest surplus yields – DEGERtraker up to 45 %, TOPtraker up to 30 %
- Best price/performance ratio, leading to rapid amortization
- Also suitable for desert and equatorial regions
- Low internal consumption – well thought-out mechanics permit the use of cost-effective mini DC motors
- Short set-up times
- TÜV tested and certified, UL/CSA certified
- Has passed the hardest load tests of the Stuttgart Institute for Material Testing (MPA) Stuttgart
- Appropriate for all standard module and converter types
- Low maintenance
- High service life
- 99,9 % recyclable by using aluminum and steel designs
- Low transport costs – for DEGERtraker up to 150 kWp per truck load
- Statics tested in wind tunnel tests

DEGERenergie – YOUR SPECIALIST FOR TRACKING SYSTEMS

- Experience since 1999 in the field of tracking systems
- Sustainable reliability with high product quality and ongoing developments
- More than 30.000 DEGER systems connected to the electricity network worldwide (status: 01/2010)
- More than 160 MWp installed power
- Production capacity of 2 MW/week
- Planning security – warranty model for all solar park sizes for up to 20 years
- Expertise and German engineering – Made in Germany
- The widest range of products – solutions for every eventuality

THIS IS WHAT YOU CAN EXPECT FROM US

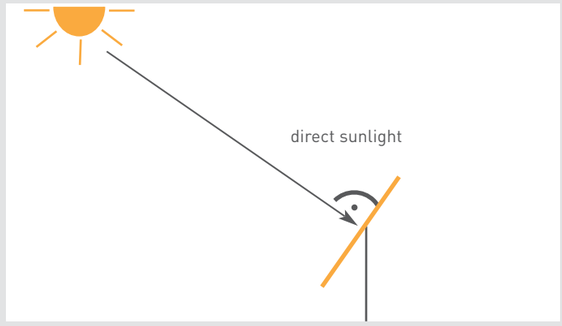
- Motivated employees and competent advice service
- Market presence & representatives on all important markets
- Low investment costs – cost comparisons
- Profitability analyses and feasibility studies
- Rapid response from our departments

THE INTELLIGENT CONTROL

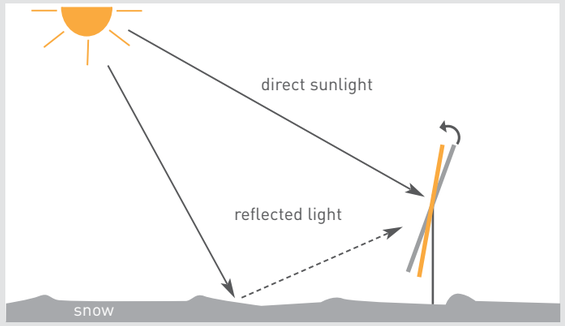
DEGERconecter

Astronomical control | DEGERconecter control

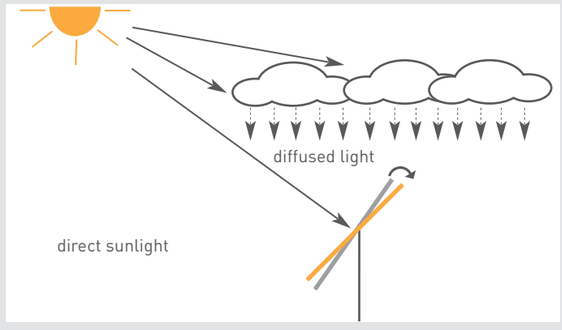
The effectiveness of the solar plant depends essentially on how much energy the solar cells are able to collect. The intelligent control of the DEGERenergie tracking systems guarantees the optimum utilisation of all incidental light energy.



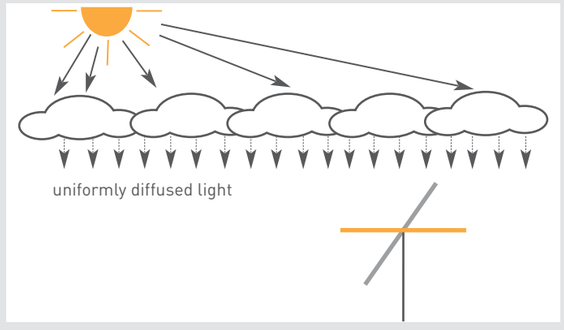
With bright sunshine: The DEGERtraker aligns itself with the brightest point in the sky.



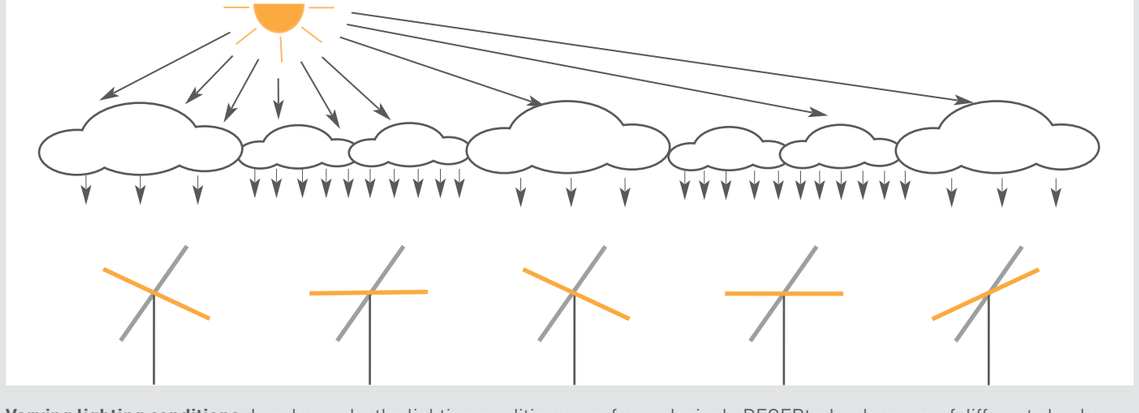
Snow: The DEGERenergie tracking system uses direct light irradiation as well as the energy of reflected light.



Scattered clouds: beside direct solar radiation also diffuse light is used optimally.



Overcast sky: the system detects the brightest spot and directs itself towards the spot.



Varying lighting conditions: In solar parks the lighting conditions vary for each single DEGERtraker because of different clouds. The individual control aligns every DEGERtraker optimally to the brightest light source and guarantees therefore the biggest possible energy gain.

DEGERENERGIE
SOLAR TRACKING SYSTEMS

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